Alternative: Appropriate Flood Flows During Spill Years

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1. Summary of the Alternative

The goal of this alternative is to appropriate flows above and below the Otowi gage that would be available only in the unusual circumstance that an actual or hypothetical spill would occur at Elephant Butte Dam. In simple terms, an actual spill occurs when the reservoir spills or releases water for flood control. A hypothetical spill occurs if an actual spill would have occurred but for changes in the upstream release regime. In either case, Rio Grande Compact limitations on this alternative would be avoided because a real or hypothetical spill at Elephant Butte Dam would erase all debts and credits of the three Compact signatory states (Colorado, New Mexico and Texas). Successful appropriation of flood flows by the Jemez y Sangre region would result in a net increase in water available to the region during the very wet years. This excess water could be (1) diverted and used to meet demand or (2) captured and stored in local or upstream reservoirs or in aquifers for future use. The key issue is determining if excess water is available above and below the gage. Because the region has not been entirely adjudicated, the total number of water rights is unknown.

2. Technical Feasibility

Elephant Butte Reservoir has spilled in 6 years between 1940 and 1997 (SSPA, 2000), or in about 10 percent of those years. Given this low frequency, construction of additional costly diversion structures solely for the purpose of appropriating this water would not likely be feasible. If, however, additional streamflow during the spill years could be diverted to the existing reservoirs in the region, or if aquifer storage and recovery facilities are in place, the spill year streamflow could be used to recharge groundwater supplies. Discussions regarding reservoir storage and aquifer storage and recovery are provided in separate white papers (DBS&A, 2002c, 2002a). Since Elephant Butte spills only in wet years, when water supplies are

likely to be fairly abundant within the region, this alternative will be most advantageous if water can be stored. The problem is that storage is often not available in wet years.

Ideally, in order to determine how much flow would potentially be available during spill years, historical flood flows would be compared to water rights to determine the amount of water, if any, that exceeded water rights during the historical spill years. However, until the area has been adjudicated, an analysis of how much flow would be available is not possible. Instead, the annual flow for four gaging stations in the region during Elephant Butte spill years was examined (Table 1). All of the gages are affected by reservoir releases and consequently do not represent natural flow conditions. Nevertheless, comparing the flows for the spill years to the long-term average flows indicates the magnitude of flows that may be expected in the spill years.

3. Financial Feasibility

As discussed in Section 4, the costs associated with this alternative if existing infrastructure is used are related primarily to submission of the water rights application, which would include minimal filing costs. Legal and technical consulting costs would be standard unless the New Mexico Office of the State Engineer (OSE) required specialized technical studies (to establish no impairment). The total cost of the appropriation process, including the legal process and supporting hydrologic studies, should be in the range of $200,000 to $500,000.

As discussed in Section 2, this alternative will be most feasible if the excess water is stored for future use. However, if additional storage or artificial recharge facilities are needed to capture and store the water, the costs would be significant. As discussed in a separate white paper, design and construction costs for aquifer storage and recovery facilities can range from about $2 to $10 million (DBS&A, 2002a). Costs for construction of new reservoir facilities vary greatly depending on size, on the order of $10 million to $50 million (DBS&A, 2002c).

Table 1. Flow Analysis for Spill Years at Elephant Butte Reservoir

Water Year	Total Flow (ac-ft)	Amount Exceeding Annual Median [a] (ac-ft)
Gage 08316000, Santa Fe River near Santa Fe (1913 to2001 period of record) *Annual median for period of record is 4,700 afy* [b]		
1942	12,307	7,607
1985	12,190	7,490
1986	5,903	1,203
1987	9,675	4,975
1988	4,496	–204
1995	7,864	3,164
Total period of record annual average	5,877	NA
Average flow for spill years	8,739	4,039
Gage 8313000, Rio Grande at Otowi Bridge, NM (10/01/18 to 09/30/00 period of record) Annual median for period of record is 1,064,157 afy		
1942	2,404,713	1,340,556
1985	1,934,727	870,570
1986	1,753,971	689,814
1987	2,000,890	936,733
1988	835,651	–228,506
1995	1,617,500	553,343
Total period of record annual average	1,083,388	NA
Average flow for spill years	1,757,909	693,752
Gage 8317400, Rio Grande below Cochiti Dam, NM (10/01/70 to 09/30/00 period of record) *Annual median for period of record is 1,027,393 afy*		
1985	1,691,150	663,756
1986	1,705,033	667,640
1987	1,694,570	667,177
1988	880,798	–146,595
1995	1,556,078	528,685
Total period of record annual average	1,033,211	NA
Average flow for spill years	1,505,526	478,133

[a] Total amount above the long-term median does not equal the potential amount available for diversion during a spill year. Until the basin is adjudicated, the amount of water in excess of the water rights cannot be determined.

[b] City of Santa Fe has water rights on the Santa Fe River of 5,040 afy, which is 340 afy more than the median, 837 afy less than the average

ac-ft = Acre-feet
afy = Acre-feet per year
NA = Not applicable

4. Legal Feasibility

Generally, the surface waters of the Rio Grande are considered "fully or over-appropriated." However, just because the flows in an average year may be less than the amount needed to supply all existing rights does not mean that additional appropriations could not be satisfied in spill years. As an extreme example, a right to appropriate 100-year flood flows could be exercised on average once every 100 years without impairing existing water rights. A more practicable example would occur when flows above the quantity needed to satisfy existing uses could be appropriated without impairment to other diverters. In many years insufficient flows would be available and the right could not be exercised, but in years of higher flows, appropriations could be made.

An applicant may commence a request to appropriate surface waters by first filing a notice to appropriate and then filing an application to appropriate (NMSA 1978, §72-5-1 (1907)). The notice is not required, but establishes the applicant's priority date and allows time to prepare the application. After filing a notice, the applicant has up to three years to file the application and still have the appropriation relate back to the filing date of the notice (State Engineer Rules and Regulations, Surface Waters, II.B [August 1953]). The State Engineer will then determine whether a permit may be issued:

> Upon the receipt of the proofs of publication, . . . the state engineer shall determine, from the evidence presented by the parties interested, from such surveys of the water supply as may be available and from the records, whether there is unappropriated water available for the benefit of the applicant. If so, and if the proposed appropriation is not contrary to the conservation of water within the state and is not detrimental to the public welfare of the state, the state engineer shall endorse his approval on the application, which shall become a permit to appropriate water . . .. (NMSA 1978, §72-5-6)

Because of the very junior status of any new appropriation, the permit would require the complete curtailment of river depletions during low flow conditions because no water would be available to fulfill the new appropriation. As a result, unless a conjunctive management alternative were in place, diversions would have to be made directly from surface flows in order

to keep the junior use in priority, as discussed in the white paper on conjunctive use (DBS&A, 2002b).

Another legal restraint that applies to appropriations within the Rio Grande Basin is derived from the Rio Grande Compact of 1938 (NMSA 1978, §72-15-23). The Compact utilizes an input-output model to determine the water delivery obligations of Colorado and New Mexico. The Rio Grande Joint Investigation of the Upper Rio Grande Basin in Colorado, New Mexico, and Texas that took place on December 23, 1937 (hereinafter referred to as the Rio Grande Joint Investigation) (Natural Resources Committee, 1938) compiled data over a number of years to determine water inflow and outflow at various points in the Rio Grande system and to establish relationships between inflows and outflows based upon the level of use as of 1929. The investigation established the relationships between (1) inflows in the San Luis Valley in Colorado and outflows at the Colorado/New Mexico state line and (2) inflows in the Middle Rio Grande Valley and outflows into Elephant Butte Reservoir. These correlations were used to establish water delivery schedules for Colorado to New Mexico and New Mexico to Elephant Butte Dam, and these schedules were expressly incorporated in the Compact (Hill, 1974; Rio Grande Compact arts. III, IV; Natural Resources Committee, 1938).

Pursuant to the 1938 Compact delivery schedules, measurements at gages in the Rio Grande and its tributaries in Colorado determine Colorado's delivery obligation to New Mexico. Delivery is measured at the Lobatos gaging station near the Colorado/New Mexico state line (Rio Grande Compact of 1938 arts. II, III). Similarly, flow measurements at the Otowi gage in New Mexico determine New Mexico's delivery obligation to Elephant Butte Reservoir for subsequent deliveries to Mexico, southern New Mexico, and Texas (Rio Grande Compact of 1938 art. IV). The amount of water delivered by New Mexico into Elephant Butte Reservoir is calculated by the recorded flow at the downstream gage plus or minus the net gain or loss in Elephant Butte Reservoir for that year (NMSA 1978, § 72-15-23 Historical Annotations).

The Otowi gage is in the approximate center of the Jemez y Sangre planning region. The issues discussed below are whether flood flows may be appropriated either above or below the gage. Above the gage, the Compact's inflow-outflow index is based on uses as of 1929

(DBS&A, 2002d). Appropriation of flood flows above that amount implicates Compact deliveries by reducing the amount crossing the gage and therefore the amount required to be delivered to Elephant Butte Reservoir. Below the gage, depletions are limited to a maximum of 405,000 acre-feet of waters flowing at Otowi, plus inflows between Otowi and Elephant Butte Reservoir.

An opportunity to appropriate flood flows exists when either New Mexico has accrued credits or when the reservoir is spilling. New Mexico accrues credits when its deliveries exceed scheduled deliveries. When an actual or hypothetical spill occurs, delivery obligations are reduced or eliminated. Under such circumstances, a new appropriation could be permitted without violating New Mexico's delivery obligations.

On May 22, 2001, the City of Albuquerque filed an application to appropriate nearly 200,000 acre-feet of flood flows in Abiquiu Reservoir. On June 26, 2001, Santa Fe County filed a notice to appropriate all unappropriated water above the Otowi gage, on behalf of northern New Mexico users, including the Jemez Y Sangre water planning region. The application to appropriate must be filed by June 26, 2004. Appropriation of flood flows would have to be as part of or in addition to these applications.

5. Effectiveness in Either Increasing the Available Supply or Reducing the Projected Demand

This alternative will add to the water supply in the region only during the years that Elephant Butte is spilling. During the period from 1940 through 1997, Elephant Butte spilled during the following years: 1942, 1985, 1986, 1987, 1988, and 1995. The more than 40 no-spill years during this period could easily be repeated, limiting the effectiveness of this option. However, some benefit can be gained during the years that do spill. Table 1 lists the annual streamflow during the Elephant Butte spill years measured at three gages in the planning region: (1) Santa Fe River near Santa Fe, (2) Rio Grande at Otowi Bridge, and (3) Rio Grande at Cochiti Dam. Though streamflow is affected by reservoir releases, this comparison indicates potential tributary flow increases during the spill years.

6. Environmental Implications

Capturing runoff flows can have environmental benefits such as reducing erosion, allowing the aquifer to recharge, and improving water quality (by limiting the introduction of sediment and poor-quality water due to fast-moving and poor-quality runoff). By increasing the amount of water in storage or allowing water managers to divert surface water and let the aquifer rest, the water supply in the region will become more sustainable

Having excess water in storage in upstream reservoirs would also allow water managers to maintain minimum flows in the river. For example, while normal flows are 0 to 1 cfs, the flow in rivers and tributaries following a rainstorm can be as high as 1 to 5 cfs. Water captured during these high-flow periods may be used to maintain more normal flows during the drier months. This possibility can greatly benefit aquatic species that rely on minimum flows for survival.

For these environmental benefits to be achieved, however, the water must be managed for that purpose. Appropriating the excess flow provides an additional source of water, but water managers and the region will decide how that water will be used.

Planners should carefully consider the environmental implications of how and to where excess water will be conveyed and distributed. Excess water appropriated and removed from the natural stream course would result in lower than normal flows farther downstream that might impact riparian habitat and endangered species.

7. Socioeconomic Impacts

The Jemez y Sangre region of northern New Mexico is distinguished by its rural and agricultural character, predominantly Indian and Hispano population, localized land-based economies, and pockets of persistent poverty. In particular, its Indian and Hispano populations represent some of the most unique cultures in the world, products of a long history of continuous human habitation, adaptation, and cultural blending. Land-based Indian and Hispano cultures still thrive, carrying on centuries-old cultural traditions that include distinctive land-use and

settlement patterns, agricultural and irrigation practices, natural resource stewardship practices, social relations, religious activities, and architecture. An example is the acequia tradition, which is vital both as a sustainable irrigation system for subsistence and market agriculture and as part of the social glue that holds together rural communities.

The survival of these deeply rooted local traditions is essential for the continuity of rural culture and communities and, in turn, for the local tourism industry, which is built in large part upon the singular cultural and historical personality of the region. Preservation of these traditions is therefore an important consideration in determining the socioeconomic and cultural impacts of regional water planning.

While it might provide additional available water for lower basin needs, appropriating flood flows could have a perceived negative socioeconomic and cultural impact on rural water users. However, the prior appropriation doctrine is designed to protect senior users such as acequias. In response to an application to appropriate water, the OSE would first have to determine that water is available in the region. If water were available, the applicant would have the burden of proving non-impairment. If circumstances exist where senior users would not be impaired and the application could be approved, the OSE would condition the permit such that senior users were protected. If impairment is inevitable, then the application would be denied.

If the system is not managed to protect priorities, this alternative would clearly have a negative socioeconomic and cultural impact on traditional water rights, agriculture, and communities in the upper basin. Many upper-basin acequia irrigators already perceive threats to their water rights from downstream municipalities and industries, and appropriating any additional water above Otowi gage, whether Elephant Butte Reservoir is spilling or not, will be viewed as a dangerous precedent and vigorously opposed. Recognizing the significance of this issue, the 2001 New Mexico Legislature sought to prohibit water right transfers from above to below Otowi gage in House Joint Memorials 14 and 6.

Appropriating flows below Otowi gage when Elephant Butte Reservoir is spilling would probably not stir the same opposition, but raises the same legal issues. The question of ownership of

flood flows, including the potential impacts to unadjudicated Indian water rights, is a key threshold issue that must be dealt with. In this socioeconomic context where rural water users feel they must be eternally watchful, any move to appropriate water above the Otowi gage is certain to involve a lengthy legal conflict.

Positive social and economic impacts include enhanced recreation (e.g., rafting and fishing) if water is stored aboveground, ability to maintain instream flows or other uses during subsequent drier years, reduction in damage from floods, and a decrease in dependence on groundwater, thus enhancing the yield during drier years.

8. Actions Needed to Implement/Ease of Implementation

Santa Fe County has already submitted an application to appropriate excess flows. The application will need to be supported by technical analyses to address issues of potential impairment. Should the application be successful, local governmental entities could develop contracts or joint powers agreements to establish allocations for the appropriated water and a plan for diverting and storing it when it becomes available.

9. Summary of Advantages and Disadvantages

This alternative would augment the supply available to the region and is relatively inexpensive, providing that existing infrastructure is used. Although the process to legally appropriate the water may be prolonged and difficult, the region may benefit by pursuing this alternative. Specific benefits include:

- Reducing damage caused by flood flows
- Saving the aquifer by using renewable supplies when available
- Creating the potential for instream use at a later, drier year, if the water can be stored.

Disadvantages of pursuing this alternative include:

- Uncertainty regarding the availability of excess flows
- Limitations on storing excess flow
- High cost and difficult implementation if new storage is required

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